2.0 SITUATION ANALYSIS

This section provides an analysis of the current DOE pollution prevention program as it relates to its environmental management challenges. The extent of waste generation throughout the complex is described in order to identify areas to which pollution prevention can be applied. Programmatic strengths and weaknesses in implementing the pollution prevention program are discussed to demonstrate the progress DOE has made, and that which remains to be accomplished.

2.1 Trends

The Department, the President, and the Congress are working to bring the Federal budget into balance within the next several years. This and other developments led to the Department's Strategic Alignment Implementation Plan, issued by the Secretary on August 3, 1995. Over the next 5 years, the alignment will decentralize many Departmental functions by shifting responsibility for them to the field. The Department plans to cut $14.1 billion from its budget over 5 years through productivity increases and a more tightly focused mission.

The Department continues to adjust to the end of the Cold War. Whereas the mission of DOE and its predecessor agencies over the past several decades had been nuclear weapons production, its current mission has largely shifted to weapons stewardship, energy research and development, and cleaning up from past practices. With facilities and sites being decommissioned, waste generation is increasing; much of the resulting waste must undergo costly treatment, storage, and disposal.

Cost-effective management, including treatment, storage, and disposal of environmental restoration wastes represents a significant Departmental challenge. Pollution prevention practices are at an early stage within environmental restoration activities and could contribute significantly to the success of these programs.

2.2 Extent of Waste Generation

Waste generation data contained in this plan originated from three sources: the DOE *Annual Report on Waste Generation and Waste Minimization Progress, 1993* (Annual Report); the National Library of Medicine's TOXNET database; and the draft *1996 Baseline Environmental Management Report*.

2.2.1 Annual Report Findings

The Annual Report contains waste generation data for calendar years 1991, 1992, and 1993. Beginning in 1993, the data were subdivided into routine operations wastes and cleanup/stabilization wastes for comparison purposes.

Routine Operations Waste – Normal operations waste produced from any type of production, analytical, and/or research and development laboratory operations; treatment, storage, or disposal operations; "work-for-others;" or any periodic and *recurring* work that is considered *ongoing*. The term "normal operations" refers to the type of ongoing process (e.g., production), *not* to the specific activity that produced the waste.

Cleanup/Stabilization Waste – Cleanup/stabilization encompasses a complex range of activities including environmental restoration of contaminated media (soil, groundwater, surface water, sediments, etc.); stabilization of nuclear and nonnuclear (chemical) materials; and deactivation and decommissioning (including decontamination) of facilities. Cleanup/stabilization waste consists of one-time operations waste produced from environmental restoration program activities, including primary and secondary wastes associated with retrieval and remediation operations; "legacy

wastes;" and wastes from decontamination and decommissioning/transition operations. It also includes all Toxic Substances Control Act (TSCA) regulated wastes, such as polychlorinated biphenyl-contaminated fluids and/or equipment. Note that cleanup/stabilization activities that generate wastes do not necessarily occur at a single point in time, but may have a duration of several years during which wastes are produced. By definition, these activities are not considered to be routine (periodic and/or on-going), because *the waste is a direct result of past operations and activities*, rather than of a current process. Newly generated wastes produced during these "one-time operations" are considered to be a secondary waste stream, and are separately accounted for whenever possible. This secondary (newly generated) waste usually results from common activities such as handling, sampling, treatment, repackaging, shipping, etc.

Periodic laboratory or facility clean-outs and spill cleanups which occur as a result of these processes are also considered normal operations.

Table 2.1 contains waste generation data for each CSO for calendar years 1991, 1992, and 1993. Table 2.2 shows DOE-wide waste generation rates by radioactive waste type (high-level, low-level, low-level mixed, and transuranic), and by hazardous and sanitary wastes.

In 1993, the Department demonstrated substantial progress in reducing low-level mixed wastes. Despite a changing mission, however, the Department still generates more radioactive waste than it does sanitary waste. Much of this is due to DOE's environmental restoration activities, which retrieve previously generated radioactive waste, and its stabilization/deactivation and decommissioning activities, which retrieve primary wastes and generate secondary wastes as a function of cleaning facilities and sites.

Table 2.1 Summary of Waste Generation Rates for 1991 through 1993 by Cognizant Secretarial Office*
(Source: Annual Report on Waste Generation and Waste Minimization Progress)

Table 2.2 Department-Wide Generation Rates for 1991 through 1993 by Waste Type*
(Source: Annual Report on Waste Generation and Waste Minimization Progress)

Figure 2.1 shows that 85 percent of the hazardous waste and 66 percent of the radioactive waste reported in 1993 are wastes retrieved from environmental restoration program cleanup/stabilization activities.

The recorded generation rate of sanitary waste has been increasing in part because of better tracking by sites. A significant amount of this waste has been diverted from landfills due to increased recycling efforts. In 1992, approximately 20 percent, or 24,000 metric tons, of sanitary waste was recycled. In 1993, sanitary waste recycling increased to 60,000 metric tons (approximately one third of the total generated).

Figure 2.1 1993 Percentages of Routine Operations and Cleanup/Stabilization Waste Generation for Hazardous and Radioactive Waste Types
(Source: 1993 Annual Report)

2.2.2 Toxic Chemical Release Inventory Report Findings

Executive Order 12856 directs all Federal agencies to comply with EPCRA and the Pollution Prevention Act of 1990. In addition, the Order directs each Federal agency to set a voluntary goal to reduce its total releases and off-site transfers of EPCRA Section 313 listed toxic chemicals 50 percent by the end of 1999.

As a result of its commitment in 1992 to voluntary Toxic Chemical Release Inventory (TRI) reporting, DOE initiated early reporting and has established

CY 1993 as its baseline year for measuring progress toward the reduction goal. The DOE 1993 baseline total of releases to the environment and off-site transfers for treatment and disposal was 4,677,836 pounds. Sites submit TRI reports for each chemical based upon whether they manufacture, process, or otherwise use that chemical above a threshold amount (25,000 or 10,000 pounds). Because 23 DOE sites reported in 1993, and because the number of sites reporting in the future may increase or decrease, the Department will measure its progress not on the number of facilities reporting, but on total pounds reduced across the complex (as reported in the TRI) compared to the 1993 baseline.

To achieve the 50 percent reduction goal by the end of 1999, DOE will need to focus efforts on the specific chemicals and sites which contributed the largest amounts to the 1993 baseline. Figure 2.2 identifies the respective percentages of the total 1993 reported quantity for the six largest contributing chemicals. Methanol represents 78 percent of all the toxic chemicals DOE reported as released to the environment or transferred off-site for treatment or disposal during CY 1993. Figure 2.3 shows the DOE sites whose releases and off-site transfers constituted more than 1 percent of DOE's 1993 baseline. Notably, the Naval Petroleum Reserve #1 (NPR-1) represents 81 percent of the 1993 DOE-wide TRI total. After CY 1993 methanol quantities from NPR-1 were estimated and reported to EPA, further analytical tests were conducted which determined that the release values were actually about 90 percent lower than originally reported. It is expected that NPR-1 will amend its CY 1993 TRI report and will submit the information to EPA for inclusion in the TOXNET database. Excluding NPR-1, the Idaho National Engineering Laboratory (INEL) accounts for 41 percent of the TRI total remaining. Complete DOE TRI data are available

Figure 2.2 CY 1993 DOE Facility Releases and Transfers for Treatment and Disposal by TRI Chemical (Source: TOXNET)

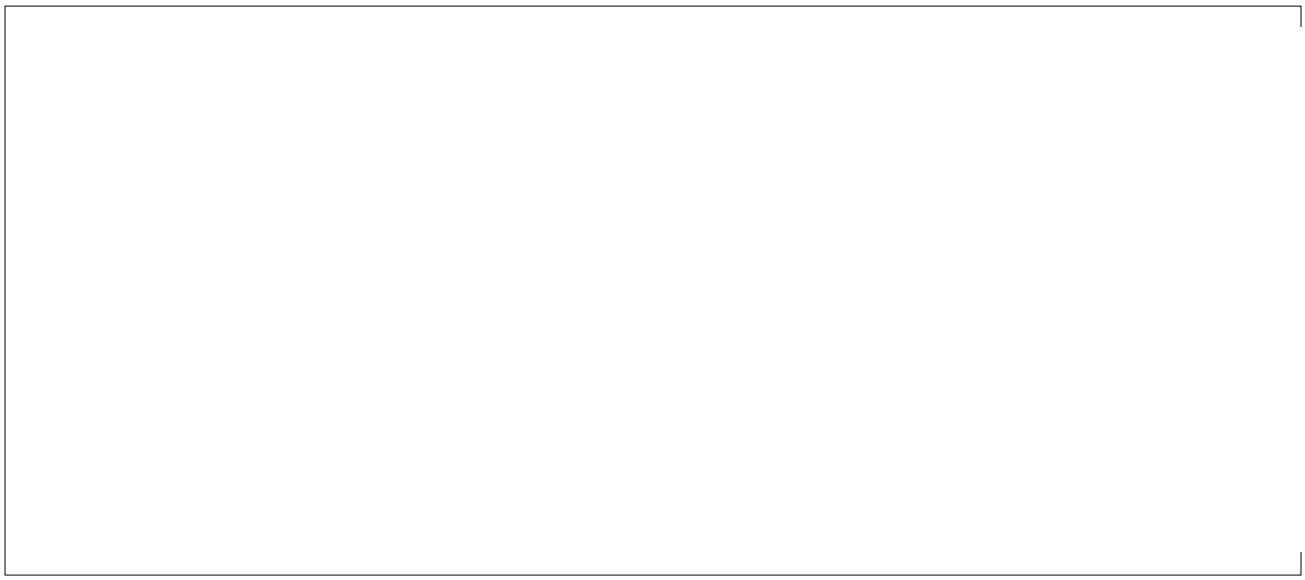

Figure 2.3 CY 1993 DOE Facility Releases and Transfers of TRI Chemicals for Treatment and Disposal by Site (Source: TOXNET)

on the Internet at http://www.eh.doe.gov/oepa/facility/tri/tri_data.htm. To access these data, readers must use a PDF viewer such as Acrobat Reader.

2.2.3 Draft 1996 Baseline Environmental Management Report (BEMR) Findings

The draft 1996 BEMR contains projections of total waste volumes and management costs resulting from the activities of EM and other Departmental organizations over the life of the cleanup effort.

Waste reported in the draft 1996 BEMR can be divided into two main categories, 1) waste processed by the Office of Waste Management (EM-30), and 2) waste processed by the Office of Environmental Restoration (EM-40) and the Office of Nuclear Material and Facility Stabilization (EM-60). Waste processed by EM-30 is further divided into 3 sub-categories: 1) inventory and future EM-30 generated waste, 2) future EM-40/60 generated waste, and 3) future waste generated from non-EM DOE sources. Figure 2.4 compares the projected volumes between 1995 and 2070 for each waste type, including spent nuclear fuel, to each of the waste categories. Table 2.3 lists the actual quantities.

The data clearly indicate that more than two thirds of the waste generated over the duration of the cleanup effort will ultimately result from environmental restoration, decommissioning, and facility stabilization activities. Of this amount, more than 80 percent will be low-level waste and nearly 10 percent will be hazardous waste. Therefore, these areas may offer the greatest opportunity for pollution prevention activities.

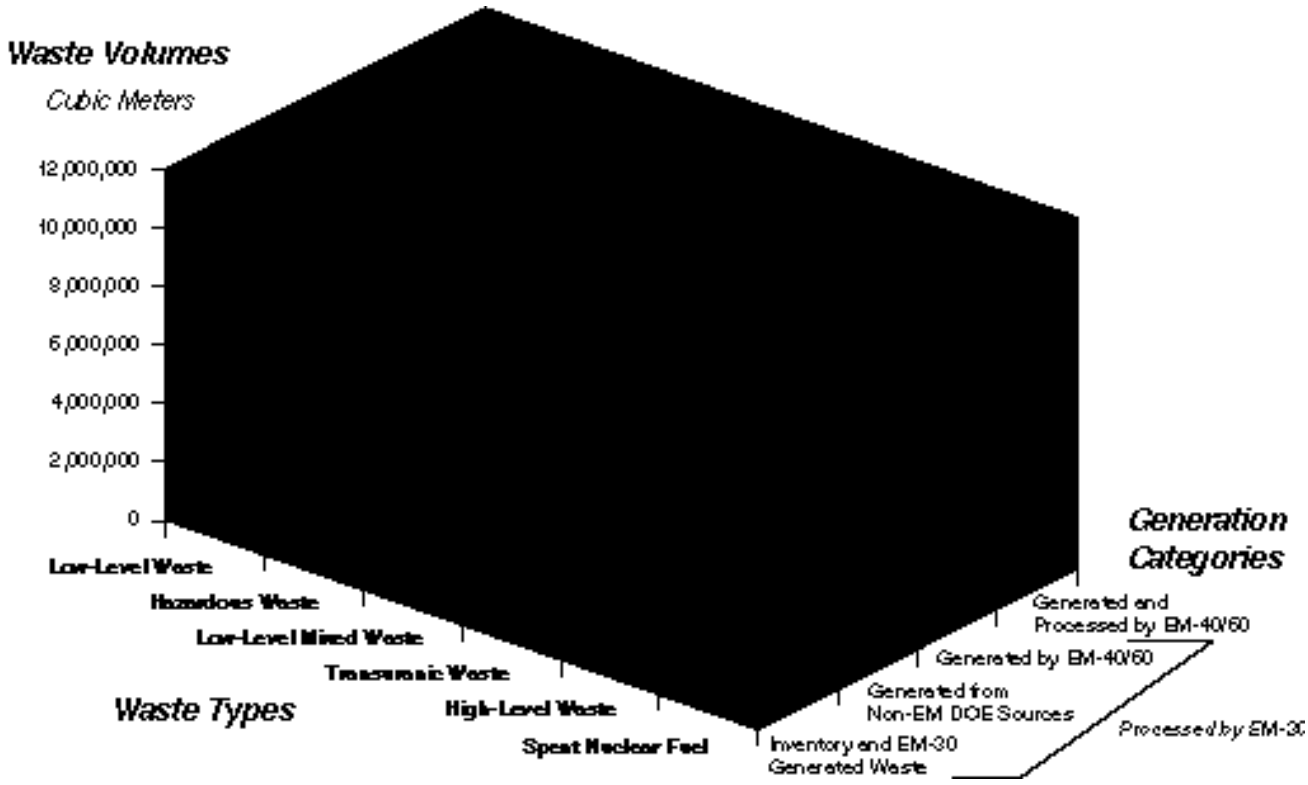

Figure 2.4 Projected Total Waste Volumes by Waste Type and Generation Category During the Lifetime of the Cleanup Effort (Source: Draft 1996 Baseline Environmental Management Report)

Table 2.3 Draft 1996 BEMR Projected Waste Volumes During the Lifetime of the Cleanup Effort* (Cubic Meters)

Waste Type	Waste Processed by EM-30			Waste Processed by EM-40 or EM-60	Totals
	Inventory and Future EM-30 Generated Waste	Future EM-40/60 Generated Waste	Future Waste Generated from Non-EM DOE Sources	Future Waste Generated by EM-40/60	
High-Level Waste	351,882	37,715	2,920	0	392,517
Spent Nuclear Fuel	2,584	0	424	0	3,008
Transuranic Waste	157,323	93,980	32,406	3,100	286,809
Low-Level Waste	717,648	2,229,660	1,394,043	11,267,000	15,608,351
Low-Level Mixed Waste	136,944	221,530	45,685	928,000	1,332,159
Hazardous Waste	45,822	286,715	290,039	1,552,474	2,175,050
Total	1,412,203	2,869,600	1,765,517	13,750,574	19,797,894

*Does not include sanitary waste, wastewater, uranium or mill tailings. Does include RCRA-, State-, & TSCA-regulated waste.

2.3 DOE Waste-Related Costs

Costs continue to rise as DOE treats, stores, and disposes of production, laboratory, and legacy wastes and performs environmental restoration activities. The draft 1996 BEMR projects the total waste management costs resulting from the activities of EM and other Departmental organizations over the next 75 years to be approximately $227 billion. Funds expended prior to 1995 (approximately $30 billion since the EM Program was established in October 1989) are not included in this cost estimate.

It is generally assumed that waste management and its resulting costs are the sole responsibility of EM. Two recent studies, however, one by Oak Ridge National Laboratory (ORNL) and one by Los Alamos National Laboratory (LANL), found that the generators can pay more than half of the life-cycle costs of low-level, hazardous, and sanitary waste treatment, storage, and disposal.

The ORNL report found that generators of hazardous waste are responsible for approximately 60 percent of the total handling and disposal costs. Such costs include procurement of the hazardous material; safety and health activities; usage and storage; and management, including maintenance, monitoring, characterization, and sampling.

The LANL study involved an analysis of costs associated with its management of low-level waste. The study determined that approximately 50 percent of those costs were borne by the generator. LANL's generator costs in this case included waste packaging, waste characterization, radiological survey, sampling and analysis, and transport documentation.

Based upon the two studies mentioned above, the costs of waste management to the generator should be considered when total waste management costs to the Department are analyzed. Generator organizations should seek mechanisms to identify and assign costs to each internal generator group.

The draft 1996 BEMR divides the EM Program into six activities: Waste Management, Environmental Restoration, Nuclear Material and Facility Stabilization Planning, Landlord, National Program Management and Planning, and Technology Development. These activities are described in detail in the draft 1996 BEMR, and the costs associated with these activities are summarized in Figure 2.5.

Waste management activities (waste storage, treatment, and disposal), after receipt from the generator, account for $111 billion and represent the largest share (49 percent) of the total cleanup costs of $227 billion. Environmental restoration has the next largest share (28 percent) of the total cleanup effort cost at $63 billion. Consequently, the largest opportunity for pollution prevention exists within these two segments.

2.4 Pollution Prevention Investments by Sites and CSOs

Sites receive pollution prevention funding through a variety of mechanisms. In the past, most of the funding came from overhead accounts and could not be directly tracked as pollution prevention funds. Table 2.4 shows total DOE budgets directly recorded on Activity Data Sheets (ADSs) and discretionary funds identified in the Environment, Safety and Health (ES&H) Management Plan. In FY 1995, pollution prevention funds were identified for the first time in the ES&H Management Plan. The purpose was to allocate funds for these programs. Because the majority of these funds are considered overhead or discretionary funds, most are not dedicated specifically for pollution prevention activities, although they are "targeted" toward them.

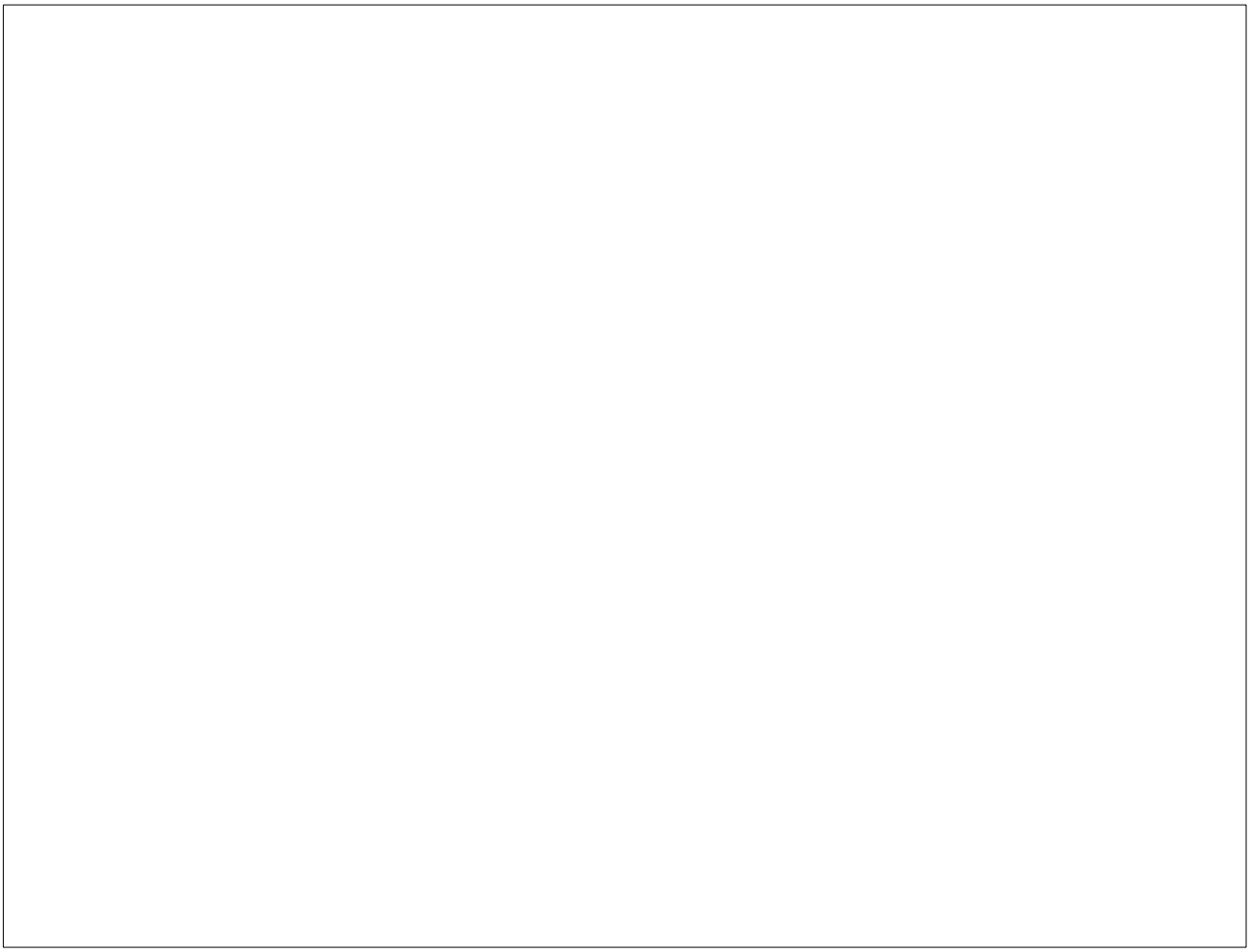

Figure 2.5 Projected Cost Estimates for the Life of the Environmental Management Program (Source: Draft 1996 Baseline Environmental Management Report)

The Department of Energy allocated 35 percent, or $5.8 billion, of its $17.2 billion FY 1995 budget for EM activities. Defense Programs activities account for $3.7 billion, while Energy Research activities account for $2.7 billion. In FY 1995, approximately 0.52 percent, or $30.3 million, of DOE's budget directly funded pollution prevention programs (see Table 2.4).

2.5 Strengths of the Overall DOE Pollution Prevention Program

Headquarters pollution prevention strengths lie in overall program planning, coordination, and evaluation. The Waste Reduction Steering Committee, which comprises representatives from all Headquarters offices, was established in July 1988 by DP to develop a pollution prevention program and provide guidance to sites. The Pollution Prevention Executive Board, consisting of all CSOs, was established in 1992 to provide overall Departmental leadership and direction for pollution prevention. The Executive Board will be chaired by the Under Secretary in 1996. Through the leadership of the Executive Board, DOE established a pilot Return-on-Investment (ROI) program that provided project-specific funding in 1994 to

Table 2.4 Total DOE Dedicated Pollution Prevention Budgets for FY 95 & 96 ($Millions)

implement pollution prevention activities that will yield significant cost savings in the short term. The Board elected to continue this program in 1995.

The *DOE Pollution Prevention Strategy* was approved by the Secretary and submitted to EPA on December 27, 1994 (see Appendix B). This document outlines the steps that DOE has taken and will take to implement Executive Order 12856 and other environmental Executive Orders. The Department is positioned to implement the strategy through its established and expanding pollution prevention program infrastructure.

Site pollution prevention strengths lie in program development, awareness, and technical support. Sites have been building programs, encouraging source reduction and recycling, and reporting progress to Headquarters in their site plans and annual waste reduction reports mentioned above. The success of site programs is due in large part to the dedication of the waste minimization coordinators and support staff. Most of the accomplishments to date are a result of grassroots efforts by staff who champion the benefits of pollution prevention.

Pursuant to DOE Order 5400.1, DOE has required the preparation of site Pollution Prevention Awareness Plans (site plans) and annual waste reduction reports since 1989.

The DOE pollution prevention program relies on the establishment and maintenance of strong site programs with commitment and support from Headquarters. The success of the overall program hinges on the ability of the sites to reduce pollutant generation and increase recycling rates, following the implementation strategy presented in Section 3. Many sites have already achieved positive results from implementing pollution prevention programs.

2.6 Challenges to Implementing a Complete Program

The Deputy Assistant Secretary for Environment, Office of Environment, Safety and Health, authorized the Office of Environmental Audit to conduct a *Special Issue Review of Pollution Prevention Management within the Department of Energy* (Special Issue Review), due to the importance of pollution prevention in meeting Departmental and national environmental performance goals. This review, although now over 1 year old, highlights

the ongoing challenges facing DOE, and illustrates areas where DOE is working to enhance its programs.

The review identified nine crosscutting challenges that impede program development and implementation:

- awareness and understanding of pollution prevention;
- management commitment;
- organizational issues;
- financial incentives and disincentives;
- pollution prevention funding prioritization;
- integration into environmental restoration;
- technical assistance;
- moratorium on offsite shipment of waste; and
- changing mission.

The review also found that most of the DOE pollution prevention funding has been allocated to program development activities and very little for project implementation. Today, a major barrier impeding the DOE pollution prevention program is the inadequacy of generator involvement in site planning and the shortage of generator project funds to implement pollution prevention opportunities.

A complete copy of the Special Issue Review can be obtained through the DOE Office of Environmental Audit, Office of Environment, Safety and Health (DOE/EH-0421) and is available via Internet at http://epic.er.doe.gov/epic.htm. The findings from the review are summarized in Appendix C.

2.7 Opportunities for Pollution Prevention

The Department currently faces significant budget cutbacks and will be required to do more with less. Pollution prevention offers an opportunity to significantly reduce costs across the complex. With effective funding and implementation of pollution prevention programs, it is reasonable to expect cost savings in the billions of dollars.

DOE's challenge to improve its operational efficiency with continually shrinking funds calls for the identification of the best long-term pollution prevention opportunities throughout the complex. Incorporating pollution prevention into new project design provides one of the greatest opportunities. Up to 80 percent of project costs are committed during the conceptual design and design engineering phases, while less than 10 percent of the costs have been incurred. Designing for pollution prevention ensures that actions implemented early in the life cycle of a project have the greatest impact on reducing waste volumes and/or management costs. The earlier such actions are taken, the greater the potential for savings.

It is clear that both waste reduction and cost savings can be realized by pollution prevention across DOE. Such savings would be partially offset by implementation costs of pollution prevention projects, but rates of return on a pollution prevention investment could reach 100 percent or higher. These potential savings offer a strong incentive to proceed aggressively with pollution prevention programs.